

RESERVE COPY

PATENT SPECIFICATION



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COMPLETE SPECIFICATION

Improvements in or relating to Automatic Photographic Film Winding Mechanism

We, KODAK LIMITED, a Company registered under the Laws of Great Britain, of Kodak House, Kingsway, London, W.C.2. (Assignees of ALVIN EDWARD SCHUBERT, a Citizen of the United States of America, of 333. State Street, Rochester, New York, United States of America,) do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to an automatic photographic film winding mechanism, more particularly for use with a photographic copying apparatus.

In U.S. Patent Specification No. 1,966,348, there is disclosed a photographic copying apparatus in which the photographic camera is loaded and unloaded in daylight, so that before beginning the photographing of the documents, it is necessary to wind on to the take-up reel that portion of the photographic film that has been exposed during the loading operation. It is also necessary to wind on to the take-up reel a number of turns of film before the film is removed from the camera so as to protect the last few photographic images from exposure to light. Hitherto, it has been necessary to effect this movement of the film by running the winding means and guessing when a sufficient length of film has been forwarded, before stopping the winding means.

It is an object of the present invention to provide a photographic film winding mechanism which is particularly applicable to photographic copying apparatus of the type disclosed in U.S. Patent Specification No. 1,966,348 and which is automatic in operation.

According to the present invention an automatic photographic film winding mechanism is provided with a winding shaft rotated by driving means which is stopped by means operated and controlled thereby when a predetermined length of film has been wound on to a take-up reel, and a main winding means for normal operation which is disconnected from said winding shaft when the latter is

being operated by said driving means.

The present invention also includes a photographic copying apparatus having an automatic film forwarding mechanism, wherein upon insertion of a copying camera into the apparatus, or removal therefrom, the film is adapted to be wound on to a take-up reel by a winding shaft which is rotated by a driving means which is stopped by means operated and controlled thereby when a predetermined length of film has been wound on to the take-up reel, a main winding means being provided for normal operation which is adapted to be disconnected from said winding shaft when the latter is being operated by said driving means.

Preferably, the driving means comprises an electric motor which is disconnected from its electrical supply by switch means operated and controlled by said motor, said switch means comprising a pair of switches adapted to be selectively inserted in the motor circuit by means of a selector switch.

In the accompanying drawing:—

Fig. 1 is a front elevation of an automatic film winding mechanism which, for clarity has been removed from its cabinet and illustrates, by way of example, one form of the present invention.

Fig. 2 is a side elevation taken substantially on the line II—II of Fig. 1.

Fig. 3 is a perspective view of a portion of the cabinet in which the film winding mechanism is mounted, showing the arrangement by which the winding operation is initiated and controlled by the cover of the cabinet.

Fig. 4 is a wiring diagram of the electrical control for the film winding mechanism, and

Fig. 5 is a partial vertical section taken substantially on the line V—V of Fig. 1, showing the arrangement whereby the winding mechanism is operatively connected to and disconnected from the camera drive shaft.

According to the form of the invention illustrated by way of example in the accompanying drawing, the cabinet (Fig. 3) contains the camera and winding

mechanism and is provided with a cover 13 which is connected thereto by a hinge 12. When the cover 13 is raised, access may be had to the interior of the cabinet 11 to place or remove the camera, not shown, but when the cover is closed, there is formed a light-tight compartment for the camera. The latter is adapted to be supported on a bracket 15 (Fig. 1) depending from and preferably formed integral with an L-shaped support, broadly designated as 16 and secured, in any well-known manner, within the cabinet 11. The vertical leg 17 of the support 16 is provided with a bearing 18 in which one end of the drive shaft 19 is journaled, the other end of which is supported in a pedestal bearing 20 extending upwardly from the horizontal leg 21 of the L-shaped support 16. The drive shaft 19 carries a sprocket 22 which may be connected to and operated in timed relation with a document conveying drum, not shown, as disclosed in U.S. Patent Specification No. 1,966,348. A one-way clutch, broadly designated as 23, operatively connects the sprocket 22 to the shaft 19 so that the latter may be driven when the document conveying drum is rotated to feed the document through the photographic field of the camera.

The other end of the drive shaft 19 rotates, in any known manner, a spring pressed pin 24 arranged to engage and drive the camera advancing roll, not shown, upon rotation of the drive shaft 19. A sleeve 25 is secured, by means of a pin 26, to the shaft 19, and is formed with a flange 27 to which is fastened a gear 28 in engagement with a gear 29 on a shaft 30 journaled in a bearing 31 formed on the vertical leg 17 of the support 16, and operatively connected to the take-up spindle, not shown, on the camera. Thus when the drive shaft 19 is rotated, the camera advancing roll and the take-up spindle will be simultaneously driven to advance the film strip through the camera to wind the strip on to the take-up reel positioned on the take-up spindle.

An auxiliary means is provided for rotating the drive shaft 19 so as to wind the film on to the take-up reel after the camera is positioned in the cabinet 11 and prior to its removal therefrom as hereinbefore explained. This auxiliary means comprises, according to the form illustrated, an electric winding motor 34, of the series type, which is mounted on the horizontal leg 21 of the support 16 (Figs. 1 and 2). The shaft 35 of the motor carries a worm 36 meshing with a worm gear 37 which is loosely mounted on the shaft 19 and has secured thereto a plate

38 (Figs. 1 and 5) on which is pivoted at 39 a pawl 40. When the gear 37 is driven by the motor 34, both the gear 37 and its plate 38 rotate in a clockwise direction, as viewed in Fig. 5, so that the nose 42 of the pawl 40 is brought into engagement with one of the teeth 43 of a ratchet 44 mounted on the end of the sleeve 25. As the sleeve 25 is pinned to the shaft 19, the pawl 40 and the ratchet 44 operatively connect the gear 37 to the drive shaft 19 so that the latter may be operated upon rotation of the motor 34. When the drive shaft 19 is thus driven, the sprocket 22 is disconnected by reason of the one-way clutch 23, but on the other hand, when the sprocket 22 is driven, the one-way clutch 23 connects the sprocket 22 to the drive shaft 19 so as to drive the latter.

The arrangement is such that if the drive shaft 19 is rotated approximately two and one half ($2\frac{1}{2}$) turns, the film which is exposed during the loading operation is moved sufficiently to bring an unexposed portion of the film strip into exposing position. On the other hand, substantially eight (8) turns of the drive shaft 19 are necessary to protect the image bearing portion of the film strip prior to the removal of the camera from the cabinet 11. For this purpose, there is provided, according to the form illustrated, an arrangement by which the raising or closing of the cover 13 closes the circuit of the winding motor 34 to wind the required amount of film, and when the film has thus been wound, the motor circuit is automatically opened to stop the motor.

Referring now to Fig. 4, there is shown a wiring diagram of the electrical circuit of the motor 34. A pair of switches, generally indicated by the numerals 46 and 47, are arranged in parallel in the motor circuit, and each comprises a stationary contact 48, and a movable contact 49 mounted on a breaker arm 50 the free end of which carries an insulating block 51, the purpose of which will be hereinafter described. It will be apparent that if either of the switches 46 or 47 is closed and connected into the motor circuit, the motor 34 will operate to drive the shaft 19 and thus wind the film on to the take-up reel of the camera. The breaker arms 50 of the switches 46 and 47 are electrically connected to contacts 52 and 53, respectively, either of which may be selectively engaged by a selector switch 54 arranged in series with the motor 34, so that either of the switches 46 or 47 may be connected into the motor circuit. It will be obvious that with this arrangement, when one of the switches 46

or 47 is connected in the motor circuit, the other switch will be disconnected.

The switch 54 is preferably in the form of a button or plunger 55 which is mounted in the side wall of the cabinet 11 and projects slightly in the path of the cover 13, as illustrated in Fig. 3. A spring 56 (Fig. 4) tends to move the switch 54 upwardly so that when the cover 13 is lifted, the switch 54 is moved to engage the contact 52, and thus connect the switch 46 with the motor circuit. When, on the other hand, the cover 13 is closed, the plunger 55 is moved downwardly so that the switch 54 now engages the contact 53 to connect the switch 47 into the circuit of the motor 34. It will be observed, therefore, that the closing or opening of the cover 13 will start the motor 34 and thus initiate the film winding operation. When the desired length of film has been wound, the motor circuit must be opened, and although this could be accomplished manually, it is preferred to employ automatic means, thus not only relieving the operator of this responsibility, but also ensuring that the proper amount of film will be wound to sufficiently protect the photographic images on the film strip.

According to the form illustrated, this result is secured by providing an arrangement for moving the breaker arms 50, thus opening the motor circuit after the proper amount of film has been wound. The particular breaker arm which is moved is, of course, determined by which switch 46 or 47 is connected into the motor circuit. For example, when the camera is loaded and placed in the cabinet 11, the cover 13 is closed thus moving the switch 54 into engagement with the contact 53 to connect the switch 47 into the motor circuit. After the drive shaft 19 has been rotated approximately two and one-half (2½) turns, the breaker arm 50 of the switch 47 is moved to open or break the contacts 48 and 49 and thus shut down the motor, as will be hereinafter described. The machine is now operated to photograph the desired documents, during which operation the motor 34 remains stationary. When, however, the photographing has been completed and the camera is to be removed, the cover 13 is lifted and the spring 56 then moves the switch 54 upwardly into engagement with the contact 52 to connect the switch 46 into the motor circuit. After the drive shaft 19 has been rotated approximately eight (8) turns to effectively wind the strip on to the take-up reel, the breaker arm 50 of the switch 46 is moved to break the contacts 48 and 49 to stop the motor 34.

In the preferred embodiment of the invention, the motor 34 not only rotates the drive shaft 19 to wind the film, but also controls the means for moving the breaker arms 50 to open the switches 46 and 47. In order to accomplish this result a gear 58 is loosely mounted on the shaft 19 and is secured to the gear 37 in any well-known manner, a spacer sleeve 59 being interposed between the gears 37 and 58 (Fig. 1) which together with the sleeve 59 are held in axial position on the shaft 19 between the sleeve 25 and a sleeve 60 pinned to the shaft by means of a pin 61.

The gear 58 meshes with a gear 62 mounted on a shaft 63 journaled in a bearing 64 extending outwardly from the vertical leg 17 of the support 16 (Fig. 1). The shaft 63 also carries a smaller gear 65 which meshes with a gear 66 secured to a shaft 67 journaled in the bearing 68 which also extends outwardly from the vertical leg 17. The worm 36 and gears 37, 58, 62, 65 and 66 thus constitute a gear train which is driven from and controlled by the winding motor 34—see Figs. 1 and 2. The gears 62 and 66 are identical, and the ratio of the revolutions of the shafts 63 and 67 is approximately 4 to 1, so that the gear 62 will make substantially four revolutions to each revolution of the gear 66.

The switches 46 and 47 are mounted on the end of an arm 71 projecting laterally from the leg 17 of the support 16 (Fig. 1), and are so positioned on the arm 71 that the insulating blocks 51 and the breaker arms 50 extend downwardly adjacent the outer surfaces of the gears 62 and 66. The gear 62 carries a cam 72 which is arranged to engage the block 51 on the switch 47 to open the latter, and the gear 66 is provided with a similar cam 73 which is arranged to engage the other block 51 to open the switch 46. As these cams engage the insulating blocks 51, the breaker arms 50 are moved to separate the contacts 48 and 49, thus opening the switches 46 and 47 and stopping the winding motor 34. However, as hereinafter described, only one of the switches 46 or 47 is connected at one time in the motor circuit, by reason of the position of the selector switch 54, and since the gear 62 makes four revolutions to one revolution of the gear 66, the former has made one revolution while the latter has made only a quarter of a revolution.

When the loaded camera is placed in the cabinet 11, the cams 72 and 73 are in the position shown in Fig. 2, the cam 72 being just beyond the insulating block 51 of the switch 47 which is closed. When the cover 13 is closed, the selector switch

54 is moved to engage the contact 53, thereby connecting the switch 47 in the motor circuit, so that the motor can rotate the gear train in the direction indicated in Fig. 2, and also rotate the drive shaft 19 to wind the film. After approximately 2½ revolutions of the drive shaft 19 have been completed, the cam 72 on the gear 62 engages the breaker block 51 on the switch 47 to open the latter and thus stop the winding motor 34. Since the gear 62 has been rotated substantially one revolution, the gear 66 has been moved approximately one-quarter of a revolution to bring the cam 73 to the position shown dotted in Fig. 2. The various documents are now photographed, and during this operation, the shaft 19 is driven by means of the sprocket 22 and the one-way clutch 23, as hereinbefore described. When, however, the photographic operation has been completed, the cover 13 is then lifted to permit the removal of the camera, and the switch 54 under the action of the spring 56 is automatically moved into engagement with the contact 52 to connect the switch 46 into the motor circuit. The motor now operates to drive the shaft 19, whereby the film is wound on to the take-up reel. When the shaft 19 has made approximately 8 revolutions, the gear 66 has moved substantially three-quarters ($\frac{3}{4}$) of a revolution to bring the cam 73 thereon into engagement with the block 51 of the switch 46 which is thereby opened to break the circuit of the winding motor 34. By means of this arrangement, the opening and closing of the cover 13 automatically closes the motor circuit through one of the switches 46 or 47 and thus initiates the winding operation. When, however, the proper amount of film has been wound on to the take-up reel, one of the cams 72 or 73 opens the switch 46 or 47 to automatically stop the winding motor.

Although the present invention has been described and illustrated as applied to the winding mechanism of a photographic copying apparatus, it will be apparent that it is applicable to any photographic film winding mechanism, and moreover, may be applied to existing apparatus.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we claim is:—

1. An automatic photographic film winding mechanism including a winding shaft rotated by a driving means which is stopped by means operated and controlled thereby when a predetermined

length of the film has been wound on to a take-up reel, and a main winding means for normal operation which is disconnected from said winding shaft when the latter is being operated by said driving means.

2. A photographic copying apparatus having an automatic film forwarding mechanism, wherein upon insertion of a copying camera into the apparatus, or removal therefrom, the film is adapted to be wound on to a take-up reel by a winding shaft which is rotated by a driving means which is stopped by means operated and controlled thereby when a predetermined length of film has been wound on to the take-up reel, a main winding means being provided for normal operation which is adapted to be disconnected from said winding shaft when the latter is being operated by said driving means.

3. A mechanism according to either of the preceding claims, wherein the main winding means includes a sprocket connected to the winding shaft by means of a one-way clutch.

4. A mechanism according to any of the preceding claims, wherein the driving means comprises an electric motor which is disconnected from its electrical supply by switch means operated and controlled by said motor.

5. A mechanism according to claim 4, wherein the switch means comprises a pair of switches adapted to be selectively inserted in the motor circuit by means of a selector switch.

6. A mechanism according to claim 4 or 5, wherein the shaft of the electric motor carries a worm meshing with a worm gear connected to the winding shaft which is adapted to rotate the take-up and supply reel spindles.

7. A mechanism according to claim 6, wherein the worm gear is connected to the winding shaft by means of a ratchet and pawl.

8. A mechanism according to claim 6 or 7, wherein the winding shaft rotates a spring pressed pin adapted to engage the spindle of the supply reel and carries a gear wheel in engagement with a second gear wheel, the shaft of which is adapted to engage the spindle of the take-up reel.

9. A mechanism according to any of claims 5—8, wherein each switch of the pair comprises a stationary contact and a movable contact mounted on a breaker arm.

10. A mechanism according to claim 9, wherein each breaker arm is adapted to be moved by means of a cam to open the contacts.

11. A mechanism according to claim 13

10. wherein each cam is carried by a separate gear wheel of a gear train adapted to be rotated by a gear wheel mounted on the winding shaft.
- 6 12. A mechanism according to claim 11, wherein the ratio of the revolutions of the two gear wheels carrying the cams is approximately 4 to 1 for the purpose set forth.
- 10 13. A mechanism according to any of claims 5—12, wherein the selector switch comprises a plunger which in its depressed position connects one of the switches in the motor circuit, and in its normal position to which is moved by a spring means, connects the other switch in said circuit.
- 15
14. A mechanism according to claim 13, wherein the plunger is adapted to be actuated upon opening and closing the cover of a cabinet enclosing the mechanism. 20
15. An automatic film winding mechanism for winding a predetermined length of film on to a take-up reel, constructed and adapted to operate as a whole substantially as herein described with reference to the accompanying drawings. 25

Dated this 22nd day of December, 1938.

RAYMOND E. CROWTHER,
Acting for the Applicants.

Fig. 1.

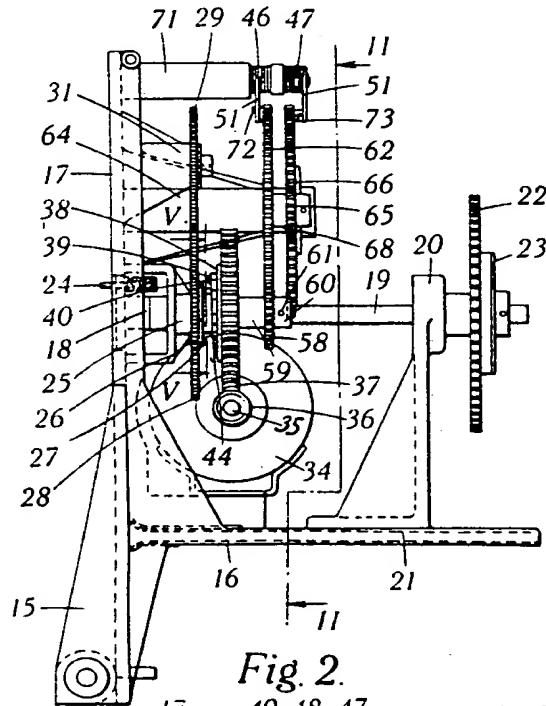


Fig. 2.

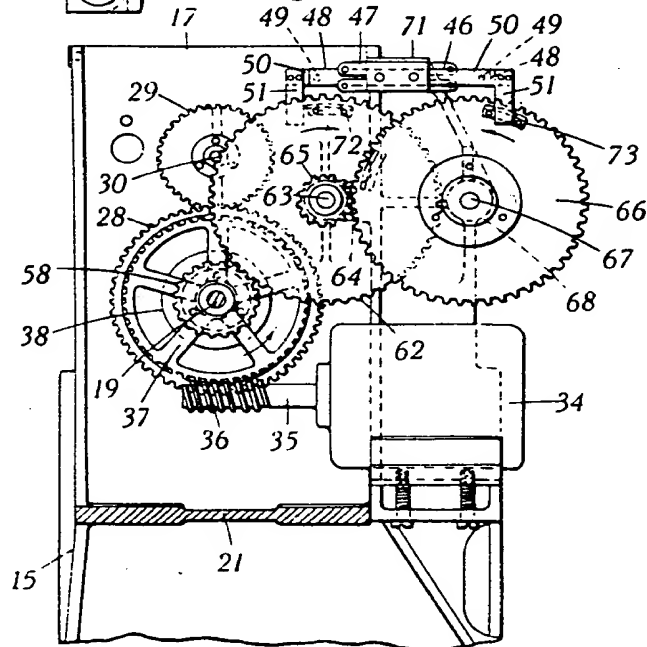


Fig. 3.

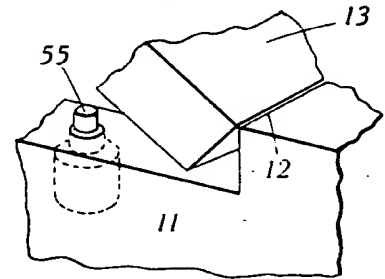


Fig. 4.

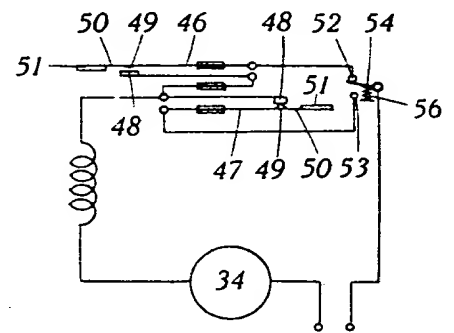
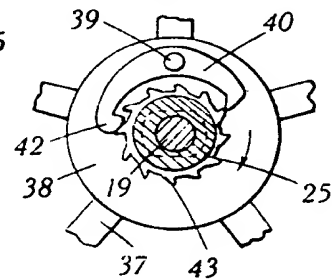


Fig. 5.



[This Drawing is a reproduction of the Original on a reduced scale.]